

Claims

What is claimed is:

1. A system for remote control of an electrically operated railroad wayside equipment having a power supply for powering the wayside equipment, said system comprising:

a central controller providing central control signals;

a transmitter associated with the controller for receiving the control signals and transmitting communications signals corresponding to the control signals; and

at least one remote equipment controller controlling operation of the wayside equipment, said equipment controller having a receiver for receiving the communications signals and for generating corresponding remote control signals for controlling the wayside equipment.

2. The system of claim 1 wherein the receiver is only responsive to communication signals which are authenticated as originating from the transmitter.

3. The system of claim 1 wherein the communication signals are encrypted by the transmitter and the receiver is only responsive to encrypted communication signals.

4. The system of claim 1 for controlling an additional electrically operated railroad wayside equipment, said system further comprising:

another equipment controller controlling the additional wayside equipment, said another equipment controller for receiving the communications signals from

the transmitter and for generating corresponding control signals for controlling the additional wayside equipment.

5. The system of claim 4 wherein the transmitter is a controller remote signal driver interface (RSDi), wherein the equipment controller is a first RSDi, wherein the another equipment controller is a second RSDi, and wherein the communications signals are transmitted over power lines connecting the controller RSDi, the first RSDi and the second RSDi.

6. The system of claim 4 wherein the transmitter is a controller rf remote signal driver interface (rf RSDi), wherein the equipment controller is a first rf RSDi, wherein the another equipment controller is a second rf RSDi, and wherein the communications signals are rf signals transmitted between the controller rf RSDi, the first rf RSDi and the second rf RSDi.

7. The system of claim 4 wherein the transmitter is a controller cable remote signal driver interface (cable RSDi), wherein the equipment controller is a first cable RSDi, wherein the another equipment controller is a second cable RSDi, and wherein the communications signals are cable signals transmitted between the controller cable RSDi, the first cable RSDi and the second cable RSDi via a cable comprising a dedicated wire pair or fiber optic cable.

8. The system of claim 4 wherein said transmitter, said receiver, said controller and said equipment controller together constitute a retrofit kit for use with the switched power supply and for use with an existing

power line that supplies power to the railroad wayside equipment via the existing switched power supply.

9. The system of claim 4 wherein the wayside equipment comprises a plurality of signal lights, a plurality of switched power supplies, each controlling one of the signal lights, and a plurality of voltage dropping circuits, all connected in series.

10. The system of claim 9 wherein the voltage dropping circuits are resistors configured such that if one or more switched power supplies controlling a less restrictive signal light is energized, a voltage applied through the resistors to the switched power supplies controlling the more restrictive signal lights falls below a threshold voltage needed to energize the more restrictive signal lights.

11. The system of claim 10 wherein the resistors are configured such that if one or more switched power supplies controlling a less restrictive signal light is not energized, a voltage applied through the resistors to the switched power supplies controlling more restrictive signal lights is above a threshold voltage needed to energize the more restrictive signal lights thereby energizing at least one of the more restrictive signal light.

12. The system of claim 1 wherein the wayside equipment includes a switched power supply for controlling the wayside equipment and a power line supplies power to the switched power supply; wherein the transmitter comprises a power line transmitter associated with the power line, said power line transmitter transmitting the

communications signals over the power line; and wherein the equipment controller comprises a power line receiver associated with the power line, said second power line receiver receiving the first communications signals via the power line.

13. The system of claim 1 wherein the transmitter is a first transceiver and wherein the equipment controller is a second transceiver integrated with a switched power supply for controlling the wayside equipment.

14. The system of claim 1 wherein the transmitter associated with the controller is a transceiver, and further comprising a sensor detecting a status of the wayside equipment and providing status signals corresponding to the detected status to the equipment controller, wherein said equipment controller provides feedback signals to the transceiver, said feedback signals corresponding to the status signals, wherein the transmitter provides signals corresponding to the feedback signals to the controller, and wherein the controller is responsive to the provided signals.

15. The system of claim 1 wherein the transmitter associated with the controller is a transceiver, wherein the wayside equipment includes a light source and further comprising a light detector detecting light emitted by the light source and providing status signals corresponding to the detected light to the equipment controller, wherein said equipment controller provides feedback signals to the transceiver, said feedback signals corresponding to the status signals, wherein the transceiver provides signals corresponding to the feedback signals to the controller,

and wherein the controller is responsive to the provided signals.

16. The system of claim 1 wherein the wayside equipment includes a switched power supply for controlling the wayside equipment and a power line supplies power to the switched power supply; wherein the transmitter comprises a rf transmitter transmitting rf communications signals; and wherein the equipment controller comprises an rf receiver receiving the rf communications signals.

17. The system of claim 16 wherein said rf transmitter, said rf receiver, said controller and said equipment controller together constitute a retrofit kit for use with the switched power supply and for use with an existing power line that supplies power to the railroad wayside equipment via the existing switched power supply.

18. The system of claim 17 wherein the wayside equipment comprises a plurality of signal lights, a plurality of switched power supplies, each controlling one of the signal lights, and a plurality of voltage dropping circuits, all connected in series.

19. The system of claim 18 wherein the voltage dropping circuits are resistors configured such that if one or more switched power supplies controlling a less restrictive signal light is energized, a voltage applied through the resistors to the switched power supplies controlling more restrictive signal lights falls below a threshold voltage needed to energize the signal lights.

20. The system of claim 1 wherein the transmitter is a first rf transceiver and wherein the equipment controller is a second rf transceiver integrated with a switched power supply for controlling the wayside equipment, the first and second rf transceivers communicating with each other via rf signals.

21. The system of claim 20 wherein each of the rf transceivers comprises a data radio transceiver.

22. The system of claim 1 wherein the transmitter associated with the controller is a rf transceiver, and further comprising a sensor detecting a status of the wayside equipment and providing status signals corresponding to the detected status to the equipment controller, wherein said equipment controller provides rf feedback signals to the rf transceiver, said rf feedback signals corresponding to the status signals, wherein the rf transceiver provides signals corresponding to the rf feedback signals to the controller, and wherein the controller is responsive to the provided signals.

23. The system of claim 1 wherein the transmitter associated with the controller is an rf transceiver, wherein the wayside equipment includes a light source and further comprising a light detector detecting light emitted by the light source and providing status signals corresponding to the detected light to the equipment controller, wherein said equipment controller provides rf feedback signals to the rf transceiver, said rf feedback signals corresponding to the status signals, wherein the rf transceiver provides signals corresponding to the rf

feedback signals to the controller, and wherein the controller is responsive to the provided signals.

24. A wayside signal system comprising:
a plurality of signal lights,

a plurality of switched power supplies, each
controlling one of the signal lights, and

a plurality of voltage dropping circuits, all
connected in series wherein the voltage dropping circuits
are configured such that if one or more switched power
supplies controlling a less restrictive signal light is
energized, a voltage applied through the voltage dropping
circuits to the switched power supplies controlling the
more restrictive signal lights falls below a threshold
voltage needed to energize the more restrictive signal
lights.

25. A wayside signal system comprising:
a plurality of signal lights,

a plurality of switched power supplies, each
controlling one of the signal lights, and

a plurality of voltage dropping circuits, all
connected in series wherein the voltage dropping circuits
are configured such that if one or more switched power
supplies controlling a less restrictive signal light is not
energized, a voltage applied through the voltage dropping
circuits to the switched power supplies controlling the
more restrictive signal lights falls above a threshold
voltage needed to energize the more restrictive signal
lights thereby energizing at least one of the more
restrictive signal lights.

26. A multiple signal device system for controlling a plurality of electrically operated railroad wayside signals, said system comprising:

- a shared media bus;

- a first local controller for controlling the wayside signals;

- a first local transceiver for providing signals from the first local controller to the shared media bus and for providing signals from the shared media bus to the first local controller;

- a first signal controller for controlling one of the wayside signals;

- a first signal transceiver for providing signals from the first signal controller to the shared media bus and for providing signals from the shared media bus to the first signal controller;

- a second signal controller for controlling another one of the wayside signals;

- a second signal transceiver for providing signals from the second signal controller to the shared media bus and for providing signals from the shared media bus to the second signal controller.

27. The system of claim 26 wherein the second signal controller and the first local transceiver are connected to the shared media bus for monitoring network traffic and for availability for control hand-off in the case of a failure.

28. A system for controlling a plurality of electrically operated railroad wayside equipment, said system comprising:

- a shared media bus

a primary controller for controlling the wayside equipment; and

a plurality of multiple signal device subsystems, each having a local controller responsive to the primary controller and communicating with a plurality of signal controllers via the shared media bus, wherein each signal controller controls one of the wayside equipment.

29. The system of claim 28 further comprising a traffic logging module connected to the shared media bus for monitoring network traffic.

30. A retrofit system for an existing system having a controller switching power to a first switched power supply circuit controlling a first signaling device and switching power to a second switched power supply circuit controlling a second signaling device, said retrofit system comprising:

a first local power source connected to the first switched power supply circuit;

a second local power source connected to the second switched power supply circuit;

a first remote signal driver interface (RSDi) for controlling the first switched power supply circuit;

a second RSDi for controlling the second switched power supply circuit; and

a primary RSDi connected to the controller for communicating with the first RSDi and the second RSDi such that the first and second switched power supply circuits are controlled by the controller via signals from the primary RSDi communicated to the first RSDi and the second RSDi.

31. A retrofit system for an existing system having a controller switching power over power lines to a first signaling device and switching power to a second signaling device, said retrofit system comprising:

a first remote signal driver interface (RSDi) for controlling the first signaling device and connected to the power lines;

a second RSDi for controlling the second signaling device and connected to the power lines; and

a primary RSDi connected to the controller for communicating with the first RSDi and the second RSDi and connected to the power lines such that the first and second signaling devices are controlled by the controller via signals from the primary RSDi communicated to the first RSDi and the second RSDi over the power lines.

32. The retrofit system of claim 31 wherein in the existing system the controller switched power over 6 power lines connected to the first signaling device and 6 power lines connected to the second signaling device and wherein the primary RSDi communicates with the first RSDi and the second RSDi via less than 6 of the power lines.